JANUARY 3, 1983

CHEMICAL & ENGINEERING

NEWS

A1250-1 1/3/83

05111179C093 9 W AR610ISL 1
CONGRESSIONAL INFO SERV
4520 EAST WEST HWY SUITE 800
SRI ACQUISITIONS
BETHESDA MD 20814

Fred Basolo

ACS President

Page 2

BEST AVAILABLE COPY

Cover: Photo by Greg Pease

CHEMICAL & ENGINEERING NEWS

Volume 61, Number 1
CENEAR 61 (1) 1–60
ISSN 0009-2347

JANUARY 3, 1983

News of the Week

■ **Oil prices seem destined to fall, but repercussions are bound to be negative as well as positive.** **Page 6**

■ **Italian government to become sole owner, through ENI, of Enoxy Chemical as Occidental sells its share.** **Page 7**

■ **Burlington's takeover bid for El Paso exceeds $600 million, but the bidding isn't over yet.** **Page 7**

■ **Nuclear Waste Policy Act of 1982 secures the House's approval by a wide margin.** **Page 7**

■ **FMC Corp.'s landfill in Minnesota tops EPA's list for having the most hazardous waste site.** **Page 8**

Business

U.S. amino acids producers boost market previously dominated by imports, balance commodity and specialty products. **Page 18**

Upjohn fills niche with introduction of Isoplast, a new engineering impact-resistant plastic with potential for wide-ranging use. **Page 20**

International

International network of chemists organized by UNESCO for exchange of services and information. **Page 21**

Petrochemical industry in Canada's Maritime Provinces seen as bright light with new sources for hydrocarbon feedstocks. **Page 24**

Government

Congress says happy new year to federal agencies with R&D funds generally higher than Administration's requests. **Page 27**

Science

New multiple quantum NMR simplifies study of molecules oriented in space, easing interpretation of their spectra. **Page 30**

Education

Industry and academia join forces to ponder the problems and opportunities of corporate interest in campus research. **Page 32**

Technology

Chemical engineering data on compounds are being gathered by institute for centralized storage and dissemination. **Page 34**

President's Message 2
Letters 4
Editor's Page 5

Concentrates
Business 17
Government 26
Science/Technology 29

The Departments
ACS Comment 37
Meetings 39
Newscripts 60

News Focus

Fire safety research focuses on the effects of toxic gases from burning plastics in building fires. **Page 9**

Capacity Jumps for Amino Acids

New U.S. producers are moving into the market, estimated at $1.2 billion in 1982, but Japanese are still dominant force

Patricia L. Layman, C&EN London

The U.S. amino acids market, which up to now has been chronically dependent on imports, is taking on more of an American accent. W. R. Grace is now bringing on stream its new plant in Deer Park, Tex., to produce glycine and other amino carboxylic acids. The firm also plans to devote much of the new $3.1 million fermentation pilot plant in Columbia, Md., to produce pharmaceutical-grade amino acids.

Moreover, earlier this year in Raleigh, N.C., the Japanese manufacturer Ajinomoto brought on stream a $37 million plant for making a variety of amino acids. And another Japanese firm, Kyowa Hakko, plans to build a plant for producing lysine at Cape Girardeau, Mo., within the next several years.

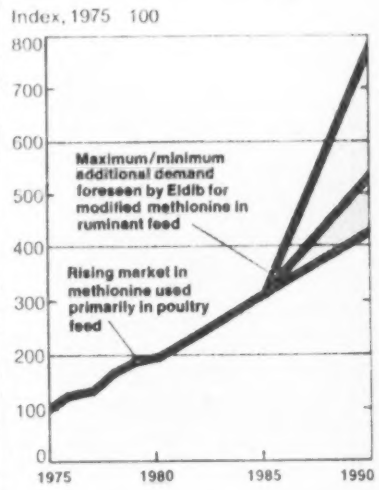
Up until these producers decided to enter the U.S. production scene, the amino acids business had been a two-sided market. U.S. producers have, indeed, been represented in the amino acids business, but in the commodities end of it, primarily with methionine. The other side—specialty amino acids—has nearly all been imported. But the market is becoming increasingly global, for both commodity and specialty products, and most observers agree that competition is heating up.

The current demand outlook gives some reason for the plant investment spurt, although U.S. capacity got way ahead of demand in methionine. For the next half decade, consultants and producers put annual physical demand growth in the U.S. on the low end of a 7 to 10% range worldwide. The highest growth could be in developing countries, where the market is just now being tapped. In 1982, total worldwide sales volume was 455,000 metric tons valued at $1.2 billion, by estimates from London-based consultants L. Hepner & Associates.

There has been one casualty in the U.S. buildup to serve this growing market. Early in 1982, Du Pont withdrew from the methionine business, closing its Beaumont, Tex., plant operations, which had been producing methionine since 1954. Du Pont was faced with a fairly stable market of probably about 115 million lb per year, supplied by three U.S. producers—itself, Monsanto, and the U.S. affiliate of the West German firm Degussa—and by importers. At that time, Monsanto was bringing on stream its new plant for methionine in Chocolate Bayou, Tex., with a capacity of 100 million lb per year, with provisions for expansion. Imports continued to be a persistent factor in the market. Hence Du Pont's decision to exit the business (C&EN, Feb. 8, 1982, page 22).

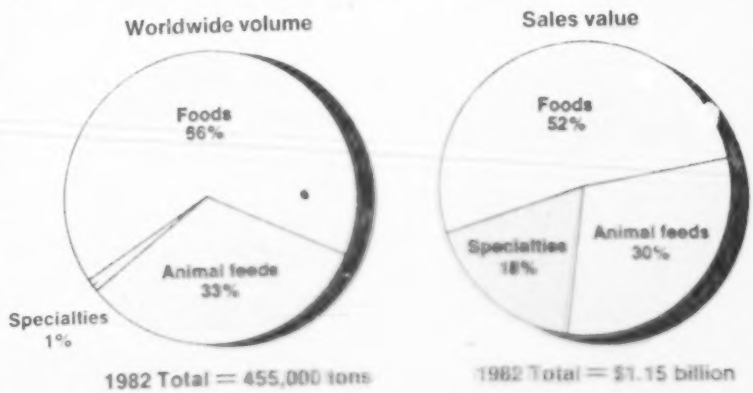
Even with the domestic entries into U.S. production, though, the worldwide picture remains dominated by Japanese producers, with Ajinomoto the largest. There probably exist fewer than 20 producers of amino acids worldwide. About half of those are Japanese firms, and the others are scattered throughout the rest of the world.

U.S. methionine market could balloon in 1980s



Source: Eldib Engineering & Research

Specialties' share of amino acids value is disproportionate



Source: L. Hepner & Associates (London)

The major reason for the Japanese technological and market dominance goes back to the development of that modest but effective food enhancer, monosodium glutamate. MSG can be extracted from soy sauce, which is rich in amino acids. Indeed, "all producers of MSG are potential producers of amino acids," says Andrew Eldib, president of Eldib Engineering & Research, a consulting firm based in Berkeley Heights, N.J. "Many are flirting with the idea; they just need the courage to take the risk."

A number of sizable risks confront new companies entering the business. Foremost among these, industry marketers say, is that little is known about Ajinomoto's technology and manufacturing costs. Says one marketer, "Nobody knows how much it costs Ajinomoto to make amino acids. Maybe they could drop the price to half of what it is—who knows?" That kind of uncertainty tends to give second thoughts to corporate officials contemplating major commitments to a market.

Additionally, the fastest-growing markets for amino acids—for use in pharmaceuticals or in nutritional formulations for intravenous solutions, for example—are the markets most difficult to enter, because of government regulations. "All those amino acids in the high-priced level must be approved by the Food & Drug Administration for pharmaceutical use," says Eldib. "That means big dollars, and the Japanese and French already have approval."

Again, that tends to discourage marketers from making major outlays for R&D to bring on stream products sold in small volumes. The $37 million Ajinomoto plant in North Carolina, for example, is slated to produce "several hundred" tons of amino acids annually. That is a typical volume for most amino acids, except for glutamic acid-derivative MSG, methionine, and lysine, which come close to or top 100,000 tons per year in demand worldwide. The fourth-largest worldwide demand, for cysteine, is probably about 1000 tons per year.

Most companies contemplating entering the market are looking at it "for the wrong reasons" and are "ignoring the dominance the Japanese have in the industry," insists Leo Hepner, a principal of L. Hepner & Associates. In the U.S., in particular, he adds, most companies would have to start from scratch to develop specialized technology and specialized lines of products, with a concommitant "tremendous capital expense, to make a few tons."

Companies that have a promising future in the field, Hepner adds, have some background in at least the chemistry relating to amino-acid synthesis, such as cyanide chemistry.

Cyanide chemistry is proving Grace's entree into the business. Through its Hampshire Chemicals unit at Nashua, N.H., Grace had a background of cyanide-based amino-acid chelating agents—nitrilotriacetic acid, for example, and ethylenediaminetriacetic acid. From there, the company has branched out

Common amino acids fall into seven broad classes

I. **Aliphatic amino acids**
Glycine
Alanine
Valine[a]
Leucine[a]
Isoleucine[a]

II. **Hydroxyamino acids**
Serine
Threonine[a]

III. **Dicarboxylic amino acids, amides**
Aspartic acid
Asparagine
Glutamic acid
Glutamine

IV. **Amino acids with basic functions**
Lysine[a]
Histidine[b]
Arginine

V. **Aromatic amino acids**
Phenylalanine[a]
Tyrosine
Tryptophan[a]

VI. **Sulfur-containing amino acids**
Cysteine
Cystine
Methionine[a]

VII. **Imino acids**
Proline
Hydroxyproline

a Essential amino acids: the human body cannot make them. b Also could be classified in group V.
Source: Mahler & Cordes, *Biological Chemistry*, 1966

Medicinal feed additives make $1 billion market

Amino acids are an important part of the market for animal-feed additives, but just medicinal additives for animal feed is a market estimated to be worth roughly $1 billion per year. Sales are dominated by three U.S. producers—Eli Lilly, Pfizer, and American Cyanamid. Together, they account for more than 65% of the market, with the remainder shared by another 20 or 30 companies. The U.S. accounts for 50% of the demand for animal feed additives, with Western Europe accounting for 30%. However, Europe and the developing countries are rapidly overtaking the U.S. Those are the conclusions of a recent study on medicinal animal feed additives from L. Hepner & Associates, a consulting company based in London.

Among the reasons the largest market share is held by the U.S., according to Hepner, is that regulatory officials there permit use of combinations of antibiotics—two or three in a single formulation. That is not permitted in Europe. Nor are high dosages—typically 200 ppm in the U.S., compared with the 20-ppm average seen in Western Europe. American agriculture also places a greater dependence on intensive farming—feeding cattle in feedlots, for example. That permits easier dosing with feed than, say, the pasture-grazing feeding still more common in Europe, Hepner suggests.

Growth promoters to accelerate absorption of feed from an animal's rumen have proved to be one of the fastest growing segments of the business during the past decade. Manufacturers also have branched out from antibiotics for humans, such as penicillin and tetracycline, to develop antibiotics especially for animals, to keep them healthy and growing and to treat disease. Those are the major changes in the animal feed industry over the past decade, the study concludes.

Many other facets of the business remain the same. It is still a competitive, almost cutthroat business, as formulators buy from an eager group of additive suppliers competing both on specific products and on development of new ones. As Hepner observes, "Feed is already a significant portion of the costs of raising an animal. How much better will another additive make it?"

into glycine, the simplest amino acid; sarcosine; and iminodiacetic acid (an intermediate), before it decided to build a plant for those compounds, among others, at Deer Park.

"We always talked about amino-acid chelating agents, amino polycarboxylic types," says Edward G. Najjar, executive vice president of Grace's organic chemicals division, based in Lexington, Mass. "But more recently, people have been talking about amino acids as a specific type, the building blocks to produce proteins." Glycine, he says, fit right in with that trend. Not only is it a chelating agent, but it is a key protein amino acid, for pharmaceuticals and nutritional products, for example.

"With the onset of the pharmaceutical market, there was a need for a U.S. source of the amino acids," Najjar adds. "We were encouraged by people to do this, even before Ajinomoto announced its plans to put up a plant in Raleigh. We had unique technology to make glycine," so the company decided to get in, looking for niches in specialty products and avoiding the commodity areas of methionine and lysine.

Synthesis, fermentation, and extraction from natural products—for example, cysteine from human hair or amino acids extracted from sugar-mill and leather-mill waste streams by ion-exchange chromatography—remain the major production techniques. Biotechnology probably will not revolutionize the business as much as make it more efficient by: allowing fermentation routes to amino acids that now are made by chemical synthesis, for example; using microorganisms to optimize the resolution of isomers or speed up a particular reaction; or using immobilized enzymes in dipeptide synthesis, perhaps.

Few of these schemes are aimed at commodity markets. Unless new fermentation routes could enable methionine to be produced at less than the $2.00 to $3.00 per kg it now costs, few potential customers would be interested. On the other hand, if production costs could be brought down enough, it might create enough demand to make full-blown commodities out of some of the specialties. For example, if a production route to tryptophan could be found so that present selling prices as high as $110 per kg could be slashed to $5.00 or $10, price-conscious compounders of animal feeds might be interested enough to put it in their bulk products.

However, most producers of specialty amino acids have their eyes on finding new markets, or getting in on the rise of ones just starting. A key market—though not a new one—for amino acids is the parenteral solutions market. These products are a third generation of fluids used to nourish the ill by intravenous or nasal-gastric feeding. Glucose was the first nutrient followed by protein hydrolysates, for example, casein hydrolysates, which had a mixture of racemic amino acids. The development of technology for producing the preferred levo form spurred the market into its third phase: It hit $30 million in 1979 and, by one estimate, probably is approaching $50 million in 1982.

Even that market faces a limit, however. There are only so many people who each year become ill enough to require such fluids. On the other hand, there is still a seemingly inexhaustible business being done in low-calorie sweetening, and amino-acid sweeteners seem poised to make the best of that. The patents covering aspartame, the major contender, are tightly held by Ajinomoto and Searle, but some industry marketers predict that, given a relative shortage of the two amino acids used to make the compound, phenylalanine and aspartic acid, other manufacturers will jump in despite the patent situation.

Peptide research is a major outlet for R&D interest in amino acids, suggests consultant Eldib. Promising areas are peptides for both male and female oral contraceptives, for diabetes treatment, and for treatments for angiotension. Such sophisticated technology or derivative chemistry could help lessen a tendency for amino acids to fall into selected specific markets—an eggs-in-one-basket problem. □

Upjohn offers new engineering plastic

An engineering resin-grade thermoplastic polyurethane has been introduced by Upjohn Co. under the tradename Isoplast that the firm expects to compete in certain niches against other engineering plastics. Company spokesmen decline to reveal the chemical nature of the resin, other than that it is an inherently impact-resistant polyurethane glass based on methylenediphenyl isocyanate (MDI). Separation of incompatible polymer segments impart impact resistance as well as give the material a milk-white, opaque appearance, which contrasts with that of transparent, amber polyurethane rubbers.

Upjohn will market the new resin through its CPR Division, Torrance, Calif. Production will continue for now on a pilot-plant scale at the firm's research center in North Haven, Conn., which developed it. Prices are from $1.90 to $2.10 per lb.

Processing is by injection molding or extrusion, with machine barrel temperatures profiled from 430 to 440 °F and a melt temperature of 450 °F. Water absorption of processed resin is only 0.17% in 24 hours, which is superior to that of some nylons, but the resin is sensitive to moisture degradation in processing. The company recommends drying to a moisture content of less than 0.03% before use.

Company spokesmen say the resin has very good resistance to abrasion, chemicals, solvents, fuels, and oils. Molded parts and extruded profiles turn yellow on long exposure to sunlight, but physical properties are said to be unimpaired.

Upjohn marketing managers see outlets for the plastic in mechanical and electrical parts for industrial, agricultural, and mining equipment; automotive interior and exterior parts; and sporting equipment.

Upjohn managers indicate that the company will make further entry into engineering plastics markets in 1983 with the introduction of thermoplastic copolyamides based on reaction of MDI and perhaps toluene diisocyanate (TDI) with azelaic, adipic, and isophthalic acids. The firm has marketed a thermoplastic polyimide for about 10 years. □